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Book reviews and notices*

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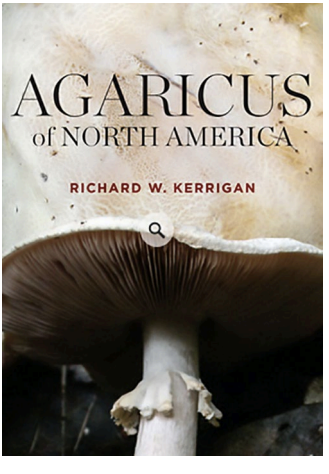
Abstract—Books reviewed include: *Basidiomycetes—Agaricus* of North America (Kerrigan 2016), *Hebeloma* (Fr.) P. Kumm. (Beker et al. 2016); *Lichens*—Lichens of Mexico (Herrera-Campos et al. 2016).

Basidiomycetes

***Agaricus* of North America.** By Richard W. Kerrigan. 2016. Memoirs of the New York Botanical Garden, Vol. 114. NYBG Press, Bronx NY 10458-5126, USA. 592 p. ~385 color plates & figures, hardback. ISSN 0077-8931; ISBN 978-0-89327-536-5. Price (excl. postage): $127.99. www.nybgpress.org



'*praeclaresquamosus*' is chewy
But the name here turns out to be hooey,
And those who like poison
Will now find their joys in
Agaricus buckmacadooi.

If you take an *Agaricus* census,
The naming will batter your senses,
Some mushrooms that pose as
'*praeclaresquamosus*'
Should really be *deardorffensis.*

The above limerick, dashed off today by British Columbian Ian Gibson (our Pacific Northwest Key Council database expert), captures the west coast's response to Rick Kerrigan's new masterpiece. A trained agaricologist,

* Book reviews or books for consideration for coverage in this column should be sent to the *Editor-in-Chief* <editor@mycotaxon.com> 6720 NW Skyline, Portland OR 97229 USA.

I nonetheless still embarrass myself hemming and hawing over a pristine *Agaricus* presented for field identification. Confidently identifying *Inocybe, Phaeocollybia, Chrysomphalina, Galerina,* and many small or 'valueless' mushrooms, I am flummoxed by the genus that gave agaricology its name. Somewhat defeated by identifications that are misapplications of European concepts, most North American field agaricologists slavishly follow Arora (1986) who—recognizing an *Agaricus* identification crisis when he saw one—cheerfully placed 'group' after species names to give the uncertain identifier a bit of wiggle room. But I digress.

Agaricus of North America is a sturdy hefty tome with stiff hard covers designed to stand up to frequent use. Owners are nonetheless advised to prepare the volume by splaying it firmly flat in sections to prime it for heavy use on lab benches.

Presentation is thorough and comprehensive. The table of contents and acknowledgments precede introductory chapters covering *Agaricus* in the (1) world and (2) commerce; history & nomenclature; literature; "To study and identify *Agaricus*" (a materials & methods section to read and re-read); formats & conventions; edibility caveats; phylogenetic analysis; sequences representing *Agaricus* sections (+ subsections & unnamed major lineages); and typifications of 10 previously published taxa.

These introductory chapters provoke. In "Why this book? Why now?" Kerrigan does not share his 45 years of *Agaricus* field experience in a field guide because "I believe that this presentation uniquely bridges a gap between the typical specialist literature and the typical field guide in a way that will interest many readers." He further notes—

> "What I have attempted to produce is a monographic technical resource that is authoritative, while remaining generally accessible, and is comprehensive to the extent that our existing knowledge allows. ... Agaricus is a difficult, subtle, phenotypically plastic genus with many, many rare and seemingly cryptic species, and North America is a big and diverse continent. ... The present volume ... is just a start, a down payment on what we as stewards of the commons deserve: an exhaustively comprehensive, absolutely authoritative summary of Agaricus in North America.... The process is far from completed."

The author ends his opening chapter with the challenge—"See if you can discover what I've missed."

In "*Agaricus* erected, disused, emended, and conserved" Rick observes—

> "As [Linnaeus] employed the name, *Agaricus* corresponded to the gilled mushrooms. Consequently, for more than a century, most new mushrooms were named as an *Agaricus,* creating a huge list of names for a diverse

> range of species (now mostly reassigned to many segregated genera). This copious nomenclatural residue is just one more cumbersome obstacle, virtually unique to *Agaricus,* impeding the simple use of correct names, thus affecting comprehension and communication."

The 33-page chapter on how to approach the genus clearly explains why so many of the collections studied are Kerrigan's own and how to avoid making collections that are destined to reside only in herbaria—uncharacterized, unattended, and decidedly unloved. The helpful five pages devoted to the objective of *Agaricus* study ["I have applied the names that in my opinion are MOST PROBABLY correct"] precede discussions on characters (macro-/microscopic, eco-/geological, biochemical, molecular, cultural), all summarized in a brief paragraph on p. 49.

Next follow the all-important keys and taxonomic treatments. The titles explain what the keys are designed to do and not do: [i] "Dichotomous key for the placement of agaricoid and secotioid specimens of *Agaricus* subg. *Agaricus* in North America to sections or groups" and "[ii] Quasi-synoptic key for the placement of specimens of *A.* subg. *Agaricus* in North America to sections or groups." The author shares his frustration in crafting keys: "...natural groups in *Agaricus*...are somewhat heterogeneous morphologically and sometimes biochemically, and frustrate attempts to produce elegant dichotomous keys, especially when emphasizing field characters." Hence the synoptic key serves as "the preferred framework for a holistic assessment of attributes and affinities. Once a section or group is selected, one or more subsidiary dichotomous keys for the individual sections follow as each section is introduced...." One complaint may be raised at using only the rDNA ITS region to support new phylogenetic sections, and readers are warned to expect several taxonomic shifts after future multigene sequence analyses are employed.

The formal taxonomic section covers 190 taxa (some represented only by RWK collection numbers) and proposes 34 new names. Descriptions are ordered based on formal section (*Bivelares, Chitonioides, Xanthodermatei, Sanguinolenti, Nigrobrunnescentes, Agaricus, Spissicaules, Subrutilescentes, Rarolentes, Minores, Arvenses*) (further divided into subsections) or the informal 'floridianus', 'longuloid/gryophragmioid', and 'martineziensis' lineages.

A typical section (e.g., *A.* sect. *Bivelares*) begins with a standard nomenclator (but containing only selected synonyms) followed by AFFINITIES, CHARACTERS, the inevitably valuable REMARKS, and KEY to species. This may or may not precede SUBSECTIONS (with their own CHARACTERS, REMARKS, and KEY). Each section/subsection includes an illustration, a graph comparing spore sizes, and a phylotree.

One to two illustrations accompany each 1–4-page species treatment: most are photos—some in situ, most 'morgue' shots of fresh material (so useful to taxonomists but too often snubbed by those hoping to see mushrooms in natural habitats), and several of herbarium exsiccati—with a few drawings or paintings. For reasons obvious to those who know how few *Agaricus* features are diagnostic under high power, there are precious few micrographs.

Species sections include nomenclator, AFFINITIES; technical DESCRIPTION; CHEMISTRY; HABIT, HABITAT, DISTRIBUTION; an always insightful DISCUSSION; and EDIBILITY. [Edibility for *Agaricus bisporus* is noted as: "This mushroom is a prized edible, the most commonly cultivated mushroom in the world, the basis of a multi-billion-dollar industry. Cultivation is not difficult—if you know how."] The amount of new information (based on a lifetime of personal observation) presented here is awe-inspiring.

And yet, there are big swaths of North America that are only superficially studied (the southern and southeastern states), while Mexico merits only a brief mention in the literature section. Most material in the book was collected in California, Pennsylvania, Colorado, and New Mexico. Focused on one continent as it is, the current volume presents keys and descriptions to cover only species confirmed by the author as occurring there.

Since the 1970s, North American agaricologists have confronted far too many misapplied names and a somewhat tumultuous "nomenclatural inconsistency" in the continent's monographs and field guides. As a test, I consulted the 55 names listed in the PNW Key Council provisional key to Pacific Northwest *Agaricus* species (Chariton 1997) to evaluate names accepted by Kerrigan against those still used by most North American field taxonomists. First eliminated were 18 provisional names from an unpublished master's thesis (Isaacs 1963); based on Oregon and Washington specimens, these were never formally proposed and thus (with one exception) missing from Kerrigan's index. After removing synonyms and names with no modern concept and adding nine newly named taxa, the PNW list tallied 39 Kerrigan-accepted *Agaricus* names. That list will grow once the PNW Key Council further mines the volume to identify which additional species inhabit British Columbia, Idaho, western Montana & Alberta, Washington, and Oregon.

The verses at the beginning encapsulate the problems faced by all North American would-be *Agaricus* identifiers. In 1972, I identified one forest mushroom as *Agaricus meleagris,* which was 'corrected' in 1974 to *A. placomyces*. In the early 80s, Oregon Mycological Society members learned that the CORRECT west coast name was *A. praeclaresquamosus* (Kerrigan 1986), only to find thereafter that it also would not serve:

> "The *Agaricus meleagris-placomyces-praeclaresquamosus* complex continues to puzzle, although Rick Kerrigan and colleagues seem to have successfully teased out the western North American cluster. After years of my spelling *A. praeclaresquamosus* Freeman slowly for fellow field mycologists, we now recognize the complex (in the Pacific Northwest at least) as *Agaricus moelleri* Wasser" (Norvell 2016).

But wait! Now *A. deardorffensis* (which has sent people to the hospital in British Columbia) and *A. buckmacadooi* (honoring Washington's own PNW Key Councilor Buck McAdoo) replace the first four errant names (Kerrigan et al. 2005, Norvell 2017). Fortunately *Agaricus* of North America elucidates the misapplied and confused European and North American concepts; those perplexed by this complex are well advised to read and commit to memory pp. 141–143, even while being aware that that the *'deardorffensis'* ITS rDNA (sequenced originally from that mushroom brought into the Vancouver Emergency Room) differs in only ONE base pair from the Tibetan species, *A. tibetensis*.

The dry humor permeating this scientific treatise on all things *Agaricus* will reassure readers who want entertainment with their erudition. I was particularly charmed by a note on the newly minted *Agaricus julius* Kerrigan (p. 394): "Misapplied Names: It has been called "the Prince" (*A. augustus*) in common usage in Colorado; perhaps now it will become the Emperor formerly known as Prince." Such wit is rarely encountered in nomenclators.

The volume concludes with biographies and *Agaricus* species of Kerrigan's North American predecessors (Charles H. Peck, William A. Murrill, Alexander H. Smith, Bill F. Isaacs, Alice E. Freeman), literature cited, lists of critically examined types and vouchers studied and/or sequenced and accepted, nomenclatural citations for the covered taxa, and a 5-page index inexplicably entitled 'Index to scientific names now (or formerly) assigned to *Agaricaceae,* with prior homonyms'[perplexing in that a comprehensive list from 1753 onwards might rival the current volume in length]. On the back of the page containing Rick's biography and photo is printed a 6-in/16-cm ruler, an incitement to all readers to go outside and get busy.

Together with the European *Agaricus* tomes (Parra 2008, 2013) and the ongoing work in Asia (e.g., Zhao et al. 2011), the genus is rapidly losing many of its secrets. We note that the work by Parra (whom Kerrigan warmly credits in his acknowledgments) is quite different in scope and execution than that by Kerrigan. Not so surprising, as Europe has a much longer and more thorough mycological tradition with many more active people in the field.

Kerrigan's solution to life's *Agaricus* problems has been a long time coming but does not disappoint. While taxonomic riddles remain (giving Rick more to do in his off time), many Gordian knots have been sliced. Although we still take refuge in Arora's 'groups', they are becoming smaller and more approachable. Misery does love company, so perhaps most comforting of all is that this North American *Agaricus* expert lets us know that he finds his genus even more difficult than the rest of us do.

Arora D. 1986. Mushrooms demystified. (2nd ed.). Ten Speed Press, Berkeley. 959 p.

Chariton LR. 1997 (reformatted by Ian Gibson April 2003). Trial field key to the species of *Agaricus* in the Pacific Northwest. Pacific Northwest Key Council. < http://www.svims.ca/council/Agari2.htm>

Isaacs BF. 1963. A survey of *Agaricus in* Washington, Oregon, and California. M.S. thesis, University of Washington, Seattle. [unpublished]

Kerrigan RW. 1986. The *Agaricales* (gilled fungi) of California. 6. *Agaricaceae.* Mad River Press, Eureka/ 62 p. + figs.

Kerrigan RW, Callac P, Guinberteau J, Challen MP, Parra LA. 2005. *Agaricus* section *Xanthodermatei:* a phylogenetic reconstruction with commentary on taxa. Mycologia 97: 1292–1315. http://dx.doi.org/10.1139/b97-058

Norvell L. 2016(1992). The regular column: That *nudum* is a *nuda?* ResearchGate author revision of Mushroom, The Journal. Winter 1991–92, 10(1): 15–17. <www.researchgate.net/publication/313159493>.

Norvell L. 2017(1988). The herbarium and how it breeds. ResearchGate author revision of Mushroom, The Journal. Summer 1986, 4(3): 6–9. <www.researchgate.net/publication/310674716>.

Parra Sánchez LA. 2008. *Agaricus* L. *Allopsalliota* Nauta & Bas. Tribu *Agaricaceae* S. Imai Parte I. Fungi Europaei 1. Edizioni Candusso.

Parra Sánchez LA. 2013. *Agaricus* L. *Allopsalliota* Nauta & Bas. Parte II. Fungi Europaei 1A. Edizioni Candusso.

Zhao RL, Karunarathna S, Raspé O, Parra LA, Guinberteau J, Moinard M, De Kesel A, Barroso G, Courtecuisse R, Hyde KD, Guelly AK, Desjardin DE, Callac P. 2011. Major clades in tropical *Agaricus*. Fungal Diversity 51: 279–296. http://dx.doi.org/10.1007/s13225-011-0136-7

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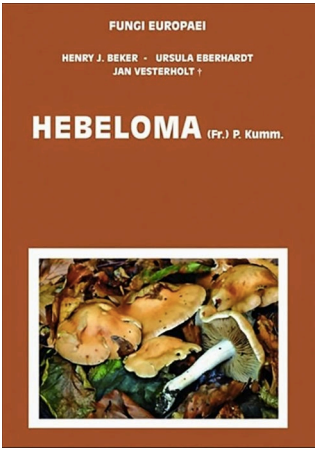
Hebeloma (Fr.) P. Kumm. By H.J. Beker, U. Eberhardt & J. Vesterholt†, 2016. Fungi Europaei 14. Candusso Edizioni s.a.s., <http://eidizionicandusso.it> ISBN 978-88-96059-42-5. 1232 pp, 2654 photos, 200 drawings. 2.8 kilos. Price 86.00 Euros.



Hebeloma is one of those genera in which species recognition has been difficult, which has resulted in a wealth of literature where authors all interpreted names differently and often brought more confusion than clarification. For Europe, there is now an excellent book that brings together a mass of knowledge and data and gives clear reasons for the species that are presented.

What sets this book apart from other taxonomic treatments is the care given to explanations on the decisions made and the different sets of characters that played a role in these decisions (biological data concerning monokaryon mating, morphological data, and molecular DNA data). In some cases morphology tipped the scale to recognize several species; in others the DNA data indicated the existence of differences. It should be noted that a combination of molecular markers was used for species delimitation and that more variable gene regions than the universally used barcode ITS region were sequenced and phylogenetically analysed.

The mating data were provided by earlier research (Aanen & Kuyper 1999) on the *Hebeloma crustuliniforme* group; the first author contributed most microscopic observations, whereas the second author brought into the mix her molecular-phylogenetic skills. Background articles on several sections had been published previously (e.g. Eberhardt et al. 2013, 2015).

The set-up of the book is comparable to others in the series. The introduction describes the different chapters and sets the tone. Those chapters cover the history of the genus, morphology and ontogeny, materials and methods, infrageneric classification, keys to sections (in different languages), six chapters treating the species in the various sections, followed by an extensive overview of ecology and habitat, a list of published names from Europe and north Africa, bibliography, and finally iconography (more than 500 pages!).

Most important is the chapter called "Our approach"—the materials and methods part. This is required reading for every taxonomist, and student in taxonomy. The care with which the research was conducted is exemplary.

Another chapter of enormous importance for taxonomists in and outside Europe is the list of names that have been published but are not included as current and valid names in the description chapters. These names come with annotations of the authors, who studied as many type collections as possible. The almost 100 pages this list comprises indicates the wealth of information here (all original diagnoses are given and, if necessary, translated into English).

All 84 species descriptions have been generated in the same way from the data in the first author's database. This means that they are standardized and follow the same order.

The keys have also been generated from the database, which means that human inflation of characters in the keys is absent.

Illustrations in the description chapters are limited to phylogenetic trees per section or subsection, phenology histograms and distribution maps, and line drawings of type specimen's microscopic characters, but the colour photographs of microscopic and macroscopic characters in chapter 17 add a wealth of information.

Species recognition still will not be easy in this genus, as the differences between species can be quite subtle, sometimes only in one morphological character that needs careful observation, and sometimes there is overlap in morphological characters among species. This is partly due to the fact that the authors sought for and found DNA regions that are more variable than ITS.

But remember, this book provides thorough arguments for or against the decisions made.

It is sad that the third author, Jan Vesterholt, did not live to see the end product of this work (Jan died in 2011). The book is dedicated to his memory; Jan brought his knowledge of the northern European species to this project (Vesterholt 2005).

This book is not the final word on the genus *Hebeloma*—far from it. The authors are now focusing on the North American taxa, and I am looking forward to this next installment. I am very curious to see how many species the two continents have in common, and whether human introductions might have played a role in these patterns.

My appreciation and admiration for the authors in tackling this difficult but important ectomycorrhizal genus hopefully shine through this review.

Aanen D, Kuyper TW, 1999. Intercompatibility tests in the *Hebeloma crustuliniforme* complex in northwestern Europe. Mycologia 91: 783–795.

Eberhardt U, Beker HJ, Vesterholt J, Dukik K, Walther G, Vila J, Brime SF. 2013. European species of *Hebeloma* section *Theobromina*. Fungal Diversity 58: 103–126. https://doi.org/10.1007/213225-12-0188-3

Eberhardt U, Beker HJ, Vesterholt J. 2015. Decrypting the *Hebeloma crustuliniforme* complex: European species of *Hebeloma* section *Denudata* subsection *Denudata* (*Agaricales*). Persoonia 35: 101–147. https://doi.org/10.3767/003158515X687704

Vesterholt J. 2005. The genus *Hebeloma*. Fungi of Northern Europe vol. 3. Svampetryk, Denmark.

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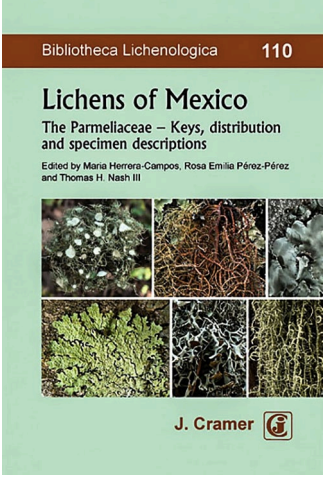
Lichens

***Lichens* of Mexico**. The *Parmeliaceae* - Keys, distribution and specimen descriptions. Maria Herrera-Campos, Rosa Emilia Pérez-Pérez & Thomas H. Nash III (eds.). 2016. Bibliotheca Lichenologica, Vol. 110; vi+723 p., 17 figs., 14x22cm. English. ISBN 978-3-443-58089-6, bound, price: 199.00 €. <www.borntraeger-cramer.de/9783443580896>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Lichens of Mexico
The Parmeliaceae – Keys, distribution and specimen descriptions
Edited by Maria Herrera-Campos, Rosa Emilia Pérez-Pérez and Thomas H. Nash III
J. Cramer

Lichens of Mexico—The *Parmeliaceae* is a valuable resource that will soon be consulted even outside of its intended region. The fact that 20% of the world's *Parmeliaceae* (including the vast majority known from North America) occur in Mexico make this volume helpful in keying out lichens outside of the country, particularly in adjacent Central America, Caribbean, and United States. Its use of the recent realignment of species into phylogenetically supported groups and genera is a particular benefit.

Thick, dense, but compact, the book is held easily in one hand. Its sturdy hardcover appears rain- and incidental spillage-proof, and its firmly bound pages of 'permanent paper conforming to ISO 9706-1994" do not crackle when splayed to prepare for heavy use. The text is crisp and legible, although the spacing is a bit tight for my aging eyes and the margins are far too narrow, forcing one's eye to jump occasionally from one long line to another—all trade offs needed to keep the book affordable and under 800 pages long. This

economy of space has the unfortunate result that even when opened firmly, text on inside margins tends to trail off into the crease. The semi-glossy photos are sharp and clear but amazingly few: As its title clearly indicates, the volume focuses on keys and descriptions. Nonetheless, readers who do read the text should be able to check most of their determinations easily against the excellent photos in Brodo et al. (2001).

Three introductory chapters set the framework for the 450 species to follow. The first, covering Mexico's geology, topography, vegetation, and diversity, provides four maps, two colored to distinguish the different climates and biomes. The country's 2 million km^2 surface area and varied landscape, climate, and ecosystems accommodate ~12% of the world's species. Herrera-Campos et al. note that it has been historically difficult to classify Mexico's biological landscape due the convergence of the Holarctic and Neotropical realms in the Tropic of Cancer, leading to the recognition of (if not agreement on) 10–32 vegetation types within the five biomes.

The second chapter—Phylogenetic structure of metacommunities in Mexican *Parmeliaceae*—presents the first lichen community phylogenetic analysis for Mexico based on the *Parmeliaceae*. Lücking et al. note that the relatively young community phylogenetics field tries to characterize the phylogenetic structure of ecological communities, thereby 'providing insights into evolutionary process' based on the theory 'that closely related species do not usually co-occur in the same community.' The few fungal and micro-organismal studies published before 2006 make these 29 pages the first to apply community phylogenetics to lichens. The 12½-page table shows the presence/absence of the 450 species in Mexico's five major biomes—tropical humid forest, humid mountain forest, temperate forest, seasonally dry forest, and dry shrubland. Species richness and phylogenetic diversity is highest in the temperate forest and lowest in the humid mountain and tropical humid forests, supporting the temperate forest as a center of diversity for Mexican *Parmeliaceae* while less diverse and more clade-specific composition of the seasonally dry forest and dry shrubland favor lineages of the parmotremoid/xanthopermelioid clade and *Oropogon*.

The third introductory chapter presents a molecular-based synopsis of generic classification of *Parmeliaceae:* since 2000, the 'increased availability of DNA sequence data has led to a second revolution of generic delimitations in *Parmeliaceae* based on molecular phylogenetic studies addressing the circumscription of genera.' Crespo et al. briefly evaluate currently accepted

genera, recapitulating recent changes in their circumscription and dividing the family into 7 phylogenetic groups:

Alectorioid—Circumscriptions of *Alectoria, Bryoria,* and *Pseudephebe* remain relatively unchanged. The 2009 separation of *Gowardia* from *Alectoria* is not currently supported, while *Nodobryoria,* segregated previously from *Bryoria,* appears not closely related to *Bryoria.*

Cetrarioid—*Cetraria, Kaernefeltia, Melanelia, Tuckermanella, Tuckermannopsis** [sic], *Vulpicida* represent a usually well-supported monophyletic clade, although current circumscriptions are needed in some instances. "Genetic distances among many currently accepted genera are remarkably low.... Thus at least some of the genera should most likely be merged." In this chapter Crespo & Barrano propose the new *Kaernefeltia iberica* comb. nov. for extralimital Spanish specimens previously referred to *K. merrillii,* a North American endemic.

Hypogymnioid—The first sentence reads: "this group consists of four foliose genera", but only three are named (probably because the authors counted *Cavernula,* whose species were transferred to *Hypogymnia* in 2011). *Brodoa* [not found in Mexico] and *Pseudevernia* are the other two hypogymnioid genera cited here.

Letharioid—Segregation of *Letharia* (found in Mexico) and *Lethariella* awaits further research.

Parmelioid—This largest group accommodates over 1800 accepted species. Of the 21 accepted genera, 5 (*Bulbothrix, Parmelia, Parmelinella,*

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*Nomenclatural note: Although the genus is misspelled '*Tuckermannopsis*' consistently throughout the volume, according to Art. 60.1 of the International code of nomenclature for algae, fungi, and plants (McNeill & al. 2012), the name honoring Edward Tuckerman should be corrected to *Tuckermanopsis,* as originally spelled for the type species *Tuckermanopsis ciliaris* (Ach.) Gyel. and as displayed on Index Fungorum <http://www.indexfungorum.org> and MycoBank <www.mycobank.org>. MycoBank lists '*Tuckermannopsis*' as an orthographic variant.

Thus far I have been unable to determine just exactly when the name acquired the extra 'n' but suspect it might have been introduced by Hale, who transferred 13 species to the genus in the 5th lichen checklist by Egan (1987). Although a Google search tends to turn up more *Tuckermannopsis* hits, the spelling used almost uniformly in the North American books on my library shelves (e.g., Hale & Cole 1988, Brodo et al. 2001 McCune & Geiser 2009), there are quite a few papers (e.g., Harris & Lendemer 2005; Randlane & Saag 2006 + many more European texts) that spell the name as proposed by the Byelorussian Gyelnik in 1933. Note also that when Esslinger (2006) carved the segregate genus, *Tuckermanella* Essl. from *Tuckermanopsis,* he correctly spelled his new genus with only one 'n'.

Parmotremopsis, Pseudoparmelia) are currently polyphyletic, in a state of flux, or lack molecular data; three (*Canoparmelia, Hypotrachyna, Xanthoparmelia*) were recently trimmed for monophyly, and three (*Melanelixia, Melanohalea, Remotrachyna*) are recent segregates. The remaining 10 well-supported monophyletic genera include *Cetrelia, Flavoparmelia, Montanelia, Myelochroa, Parmelina, Parmeliopsis, Parmotrema, Phacopsis, Punctelia,* and *Relicina.*

Protoparmelioid—confined to the polyphyletic *Protoparmelia*.

Usneoid—limited to one genus (*Usnea*) with 350 species and the most highly diverse in tropical areas. *Usnea* now includes previous segregates (e.g., *Dolichousnea, Eumitria, Neuropogon*) phylogenetically nested within it.

Genera with uncertain affinities—*Anzia,* characterised by multispored asci with small curved ascospores and a spongiostratum, is centered in eastern Asia. *Imshaugia* is distinguished by *Parmeliopsis*-like species with emergent laminal/marginal pycnidia and bacilliform/bifusiform conidia. *Menegazzia,* diagnosed by a perforated upper thallus surface, occurs primarily in the southern hemisphere. The morphological segregation of *Nodobryoria* from *Bryoria* is molecularly supported. *Oropogon* a fruticose lichen of the Neotropics with a currently unresolved phylogeny.

A key to the identification of genera representing *Parmeliaceae* in Mexico concludes the introduction.

A formidable array of *Parmeliaceae* experts have written chapters for this volume, with Editors Herrera-Campos (5), Pérez-Pérez (9), and Nash (24) and authors R.S. Egan (5), T.L. Esslinger (10), J.A. Elix (4) each contributing to more than two chapters while J.W. Bjerke, A. Crespo, P.K. Divakar, S.D. Leavitt, James Lendemer, Robert Lücking, H.T. Lumbsch, Bruce McCune, I.KK. Tronstad, J.L. Vilmaseñor, and A. Zambrano Garcia each contributed to at least one.

Thirty-nine generic chapters covering 450 species comprise the bulk (and the goal) of The *Parmeliaceae.* The note added in proof at the bottom of the section's title page hints at editorial headaches suffered over collating over 40 papers, with many undoubtedly arriving only shortly before press time:

> "Herein Dr. Egan proposes treating *everniastrum subplanum* Sipman as a synonym of *Parmotrema paramoreliense* whereas the former species was treated as *Hypotrachyna subplanum* in the *Hypotrachyna* treatment as proposed by Divakar et al. (2013a). The correct placement must await molecular investigations of all relevant material."

Genera are presented in alphabetical order and entitled with the genus name + in Mexico (except for "*Menegazzia* in Mexico and the Caribbean islands"). The chapters range in length from one page (*Cetraria, Phacopsis*) to 103 pages (*Hypotrachyna, Parmotrema*), depending on the number of species. Formatting is consistent: Title and author information are followed by abstract, short genus characterization, and species key (for genera with more than one species covered). Each species treatment begins with the taxonomic heading and nomenclator followed by morphological description, chemical composition, distribution data, and important notes and concludes with a list (often extensive) of specimens examined. Alphabetical presentation —a necessity in such a large volume with no index—and running titles enable rapid location of a particular genus. Eight species new to science are proposed in the *Alectoria* (2), *Hypotrachyna* (1), *Parmotrema* (2), *Pseudevernia* (2), and *Tuckermanella* (1) chapters.

There are a few deviations, perhaps the most startling being that only the species key, taxonomic headings, illustration references, and distributional data appear are provided for *Canoparmelia;* I regret the absence of the rest of the material but suspect that the fact this chapter was written by two already overcommitted editors, Pérez-Pérez & Nash, may have something to do with the decision to withhold the morphological and chemical features [referenced in the abstract as "Descriptions were provided previously"] and final discussions for the 13 species. Still, it will be a bit of a hassle for some readers to find the correct 'previous' paper for the missing information.

I also greatly mourn the lack of a concluding comprehensive species index that would allow easy tracking of new taxonomic realignments, always helpful to those wondering what name a favored species has recently adopted. The information can be ferreted out of the nomenclators, although the reader must know the new name to find out what happened to the old one. This does, however, have the benefit of persuading the user to consult the keys, the whole purpose of the volume!

Finally, given the focus on phylogenetic analysis of biomes, groups, and genera in this volume, I was exasperated by the lack of information regarding which DNA regions were sequenced to generate the phylogenies. A time-consuming scan of the 31-page bibliography proved somewhat helpful, although I found only three titles naming the DNA regions: mitochondrial DNA (Crespo & al. 2001), ITS & ß-tubulin (Crespo & al. 2002), and ribosomal markers + RPB1 (Crespo & al. 2007). Inspection of the multilocus sequences analyzed by Altermann et al. (2014), however,

explains why modern titles do not enumerate all DNA regions used: citing their 15 different loci (even in the abstract) would have needlessly lengthened the paper and the authors cited the needed information in their Materials & methods table. Nonetheless, the nuclear ITS, LSU and mitochondrial SSU rDNA sequences cited in the abstract for "DNA barcoding in the *Hypotrachyna* clade" abstract (Divakar et al. 2015) is information that should have been shared under *Hypotrachyna* in the third chapter. Likewise identifying the DNA barcode used to identify hidden diversity in *Parmelia* sensu stricto (Divakar et al. 2015) as derived from the ITS region should have been noted for that genus.

The rapid change in the complex molecular landscape is perhaps one reason why most authors use vague terms such as 'molecular analyses', 'DNA sequence based', or 'phylogenetic analyses' in their titles (saving the lengthier specifics for the abstracts). If a second edition is anticipated, a brief list of the DNA regions sequenced used to generate the phylogenetic support and their utility (even if just in table form) would be welcome.

The objections raised above are minor and should in no way discourage anyone from purchasing such a useful book that does precisely what it sets out to do: key and describe 450 lichens representing *Parmeliaceae* from Mexico. As noted above, its use will not (nor should) be restricted to Mexico and the reference will prove a reliable resource for all those who use it. I am very happy to have Lichens of Mexico: The *Parmeliaceae* on my lab library shelves.

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